Low-Profile Circularly-Polarized Single-Probe Broadband Antenna

Tech ID: 25538 / UC Case 2015-888-0

SUMMARY

UCLA researchers from the Department of Electrical Engineering have developed a new technology to enable single-layer single-probe circularly-polarized patch antennas with a compact size and broad axial ratio/impedance matching bandwidth.

BACKGROUND

Patch antennas are attractive due to their low profile, easy fabrication and polarization versatility; however, the design of a compact, broadband, circularly polarized (CP) patch antenna still remains a significant challenge. Most existing low-profile CP dual-band or wideband antennas require multilayer fabrication, multiple input feeds or complex fabrication processing, raising the overall antenna cost. In addition, typical single-probe CP patch antennas have axial ratio (AR)/impedance (S_{11})-matching bandwidths less than 1-2%, limiting their efficiency. Although a single-probe CP E-shaped patch antenna had been designed to achieve a 9% AR-S_{11} bandwidth, the antenna's large size limits its wide application.

INNOVATION

UCLA researchers from the department of electrical engineering have developed a new technology to fabricate CP patch antenna with compact size and decent performance. By fine-tuning the geometry of a half-E shaped patch antenna and utilizing an electrically thick substrate, a substantial size reduction of 50% is achieved compared to the original E-shaped CP patch antenna, while a satisfactory AR-S_{11} bandwidth of 5.3% can be retained.

APPLICATIONS

- The technology is ideal for wideband applications requiring circular polarizations, such as in satellite communication products (GPS, Radio-frequency identification, and direct broadcast satellite television)
- The compact size of this new antenna design could also be useful for linear or even planar arrays in high-gain satellite antennas

ADVANTAGES

- Size of the antenna is shrunk by half compared to previous E-shaped CP patch antenna
- Performance parameters such as AR bandwidth and impedance are substantially improved compared to commercial single-feed CP patch antennas
- The single-probe design facilitates low-cost fabrications

STATE OF DEVELOPMENT

A prototype operating over the WLAN band (2.4-2.53 GHz) has been developed to demonstrate the design of low-profile circularly-polarized single-probe broadband antenna for radiofrequency communication. The prototype showed a good bandwidth (5.3%, AR ≤ 3 dB and S_{11} ≤ -10 dB) with a height of roughly λ/10, along with a predominantly unidirectional radiation pattern towards the broadside direction (theta=0).

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,211,535	02/19/2019	2015-888

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OTHER INFORMATION

KEYWORDS

patch antenna, microstrip antenna, half-E shape, low profile, circularly polarized (CP), single probe, broadband, WLAN, satellite communication, radio-frequency (RF), unidirectional

CATEGORIZED AS

- **Communications**
  - Networking
  - Other
  - Wireless
- **Engineering**
  - Engineering
  - Other

RELATED CASES

2015-888-0

RELATED MATERIALS

▶ Joshua M. Kovitz, Jean Paul Santos, and Yahya Rahmat-Samii. The CP Half E-shaped Patch: Evolving from Linear Polarization to Compact Single Feed Circularly Polarized Antennas. IEEE International Symposium on Antennas and Propagation, 2015.

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

▶ Hemispherical Rectenna Arrays for Multi-Directional, Multi-Polarization, and Multi-Band Ambient RF Energy Harvesting

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